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ABSTRACT

This study analyzes the generalization abilities of children with reading disabilities by comparing the performance of such children with that of a normal control group on a conditional discrimination learning-set task. Both groups, consisting of boys aged eight to ten, participated in the Wisconsin General Test Apparatus in a form modified for human subjects. The test was administered over a nine day period. Results show that children with learning disabilities were not as adept at solving the learning-set task as was the control group. In addition, the child with learning disabilities adheres simplistically and more rigidly to a few patterns of response, while the normal child tries a complicated variety of systematic responses. The study indicates that more research on reading remediation is needed, particularly on the generalization ability of the child with reading disabilities. (HAI)

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Learning Set Acquisition by Reading Disabled and Normal Children

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Although extensive research has been undertaken to provide a better understanding of why some children have difficulty learning to read, most studies have overlooked the 'process' of learning, i.e., learning to learn. Instead, investigators have studied various possible problem areas which are peripherally related to learning to read. Some investigators have proposed the idea that brain dysfunction of particular parts of the brain (Hinshelwood, 1917) or lack of cerebral dominance (Orton, 1937) results in reading disabilities. Others have studied perceptual problems (Strauss and Lehtinen, 1947); deficits in intersensory integration (Birch and Belmont, 1965); deficits in linguistic development (Owens, Adams, Forrest, Stolz and Fisher, 1971; Wiig, Semel and Crouse, 1973) as well as sex differences, hereditary factors and neuropsychological deficits (Klasen, 1972) as influencing factors in reading disability. While these investigators have provided useful information regarding reading problems, some of the essential aspects of the learning process have been overlooked or infrequently investigated.

The aspect of the learning process which is of central importance in this investigation is generalization. Theorists and researchers who approach learning from a variety of perspectives have noted that generalization is an integral part of the learning (and reading) process. (Chomsky, 1976; Kephart, 1971; Rincover and Hayes, 1977; Stokes and Baer, 1977). All novel words and sentences which will confront a reader cannot be practiced and learned. Rules must be discerned and applied in continually novel settings, i.e., unfamiliar reading material, as a person becomes a skilled reader. If a problem occurs in this

generalization process, the application of rules as aids in learning to read does not become automatic. Under these circumstances reading becomes a tedious, trial-and-error process.

Children exhibiting reading disabilities have been observed to frequently encounter problems in generalization (Kephart, 1970; Lovitt, 1977; Wiig, Semel and Crouse, 1973; Wirtenberg and Faw, 1975). Few researchers, however, have investigated this problem. For this reason, the basic emphasis of this study is to analyze the generalization abilities of reading disabled children on a specific learning set (LS) task by comparison with the performance of a normal control group.

Method

Subjects. Two groups of children were selected for this experiment. One group consisted of eleven reading disabled children chosen from classes designated for learning disabled children. An adapted form of an operational definition of learning disabilities (Myklebust, 1968) was employed as the selection criterion for this group (see Table 1). A score of 89 or below on the learning quotient (LQ) was necessary for placement in the reading disabled group. This score indicated that a child's reading achievement was significantly below expectancy. A group of eleven children from regular classes served as a control group. All members of this group scored above 90 on the LQ. General characteristics of both groups are presented in Table 2.

Insert Table 1 and Table 2 about here

Apparatus. The testing device used in this experiment was the Wisconsin General Test Apparatus, modified for human subjects. This apparatus allows for concealed arrangement of stimulus objects and rewards before presentation, and also facilitates presentation of stimulus objects (for a more complete description, see McLeskey, 1977).

There were 100 pairs of stimulus objects, differing in multiple characteristics (e.g., size, shape, color), used in this experiment. Objects were made of wood and cut into unfamiliar shapes. Objects were painted in various colors and frequently had one or more "junk" objects (pieces of plastic or metal) attached.

Procedure. Both groups were presented conditional discrimination learning set tasks. These tasks consisted of presenting two dissimilar objects on a two-hole stimulus tray. The two objects were randomly positioned over a series of six trials. Each time the objects were presented, the background color of the stimulus tray was systematically varied (yellow or purple). Rewards for displacing objects were determined by the background color of the stimulus tray as well as the characteristics of the displaced object. Thus, for any given problem, the child was rewarded for choosing the correct compound (e.g., object "A" with a yellow background or object "B" with a purple background). Rewards were placed in food wells under the appropriate stimulus object and consisted of peanuts, cereal, and other small pieces of food. Objects and backgrounds were systematically varied using chance orders determined by Gellerman (1933) and later refined to minimize the influence of systematic bias by Fellows (1967).

Twelve problems were presented each day, six trials per problem.

For each problem, the same pair of stimulus objects was retained for six trials. Testing continued for nine days, or until a child reached a criterion of 90% correct trial two responses over a block of 24 problems, Thus a minimum of 24 problems was presented to each child.

Prior to testing, a brief period was used for explaining and demonstrating the test apparatus to each child, as well as for establishing rapport. A standard set of instructions was given to each child. During testing, supplemental instructions by the experimenter were kept to a minimum.

Results

The reading disabled and normal groups were compared on the mean proportion of correct trial two LS responses. An analysis of covariance was employed as a significant difference was noted between mean mental age (MA) scores for the two groups ($F\ [1,20] = 7.53,\ p < .05$) (See Table 3). Control of MA was deemed necessary as a moderate relationship between LS acquisition and MA has been noted in other LS investigations with normal and mentally retarded children (Kaufman and Prehm, 1966). After completing the analysis of covariance procedure, a check of assumptions revealed that this procedure was not valid as the equal slope assumption had been violated (see Figure 1) (Tatsuoka, 1971).

Insert Table 3 and Figure 1 about here

Further analysis revealed that when subgroups of the initial sample were equated on MA, LS acquisition was not influenced by the MA difference between groups (See Table 3).

The mean proportionsof correct trial two LS responses of the reading disabled and normal groups were then compared using an analysis of variance technique. This analysis revealed a significant difference between the two groups ($F\ [1, 20] = 4.77$, $p < .05$). The normal group made a greater proportion of correct responses than the reading disabled group (see Table 3).

Discussion

The results of this investigation reveal that reading disabled children have greater difficulty than normal children in generalizing as defined by the conditional discrimination learning set task used in this study. A further trend in these data reveals a differential development of strategies for solving the LS problem. This trend is supported by two factors. First, the reading disabled children seem to solve the LS problems with less facility as MA increases, while normal children solve the LS problem more quickly as MA increases. Although the small sample size used in this investigation could have influenced these results, Figure 1 illustrates that when LS acquisition is regressed on MA scores for the two groups, there is a definite interaction of the regression lines. This interaction coupled with the negative slope of the regression line for the reading disabled group and the positive slope for the normal group supports differential development of LS acquisition. Secondly, normal and reading disabled children tended to approach the problem-solving task differently. The reading disabled children seemed to rigidly adhere to a few patterns of response, while the normal group tried a wide variety of systematic responses in

attempting to solve the LS task. This pattern was particularly evident as most of the children asked questions and offered solutions to the task after testing. The solutions offered by the reading disabled children tended to be simplistic (e.g., the rewarded object is always on the right) while the normal children frequently offered complex solutions to the LS task (e.g., the rewarded object is on the left twice, then right once, left once, right twice).

Several implications for educational planning and future research can be discerned from the results of this study. Reading disabled children appear to use atypical strategies when solving the specific problem used in this investigation. These strategies seem to be inefficient as well as different when compared to strategies used by normal children. This finding suggests that strategies for problem-solving may be altered in reading disabled children to allow more efficient methods for dealing with a learning task.

A further implication relates to the generalization deficit exhibited by reading disabled children. This deficit suggests that reading instruction may be altered to take into account specific generalization skill deficits. Further delineation and confirmation of these speculations must await further research, as the present investigation is based on a limited class of problems and subjects at only one age level. Nonetheless, the results of this study are suggestive.

When considering the results of this investigation, several directions for future research become apparent. First, more basic

research is needed on LS acquisition in order to clearly delineate the problems reading disabled children exhibit in solving simpler and more difficult learning tasks. This type of investigation will not only further clarify generalization problems of reading disabled children, but will also provide the opportunity to analyze error factors (and thus the approach to the task) using simpler learning tasks (e.g., object-quality discrimination problems).

This type of research will further allow a look at possible effects of training on generalization abilities of reading disabled children, as transfer of training from one learning set to another may be analyzed using object-quality LS pre-training followed by reversal and conditional discrimination LS tasks. This aspect of the research may give valuable information regarding the trainability of strategies used by reading disabled children when approaching new learning tasks.

While definitive conclusions and remediation techniques cannot be recommended based on the research described herein, a direction for future research leading to possible reading remediation strategies is offered. Investigation of strategies used in the learning to learn process as well as methods for facilitating (or programming) generalization offers a perspective on reading problems which is as yet unexplored.

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Table 1

Adaptation of Myklebust's Definition of

Learning Disabilities

EA = Expectation Age

CA = Chronological Age

MA = Mental Age

$$EA = \frac{CA + MA}{2}$$

AA = Achievement Age (Grade level placement in reading achievement + 5.2)

$$LQ = \text{Learning Quotient} = \frac{AA}{EA} \times 100$$

Table 2

Mean chronological age, achievement age and learning quotient of reading disabled and normal children

	Group	
	Reading Disabled	Normal
Chronological Age[a]	112.45	113.00
Achievement Age[a]	94.64	133.91
Learning Quotient	82.09	106.27

[a]Expressed in months.

Table 3

Mean mental age and proportion of correct

trial two learning set responses by reading disabled and normal children

Group	n	MA[a]	LS
Reading Disabled	11	118.7	60.1
	8	123.5	57.8
Normal	11	137.1	68.6
	7	125.1	66.4

[a]Expressed in months

Figure Caption

Figure 1. Regression of learning set responses on mental age for reading disabled and normal groups.